

tuberous and bulbous plants, shrubs, &c. Epiphytes (as is to be expected in a climate of such general dryness) are few, but parasitic phanerogams are abundant. A good deal of attention is paid to the various contrivances for storing water and reducing transpiration. Other matters discussed are insects and birds as agents of pollination, the influence of wind, light, &c. Several curious instances are adduced, especially in the genus *Mesembrianthemum*, of so-called protective resemblance. Though supposed cases of mimicry in the plant kingdom should be received with caution, it must be admitted that the resemblance, both in colour and form, between some of these curious plants and the stones and rocks amongst which they grow is exceedingly striking.

The closing chapters of the volume are occupied by a useful discussion on the affinities and origin of the South African flora in general, and that of the Cape Province in particular. The older theories of Hooker and Wallace, as well as those of later authors, to account for the resemblances between the floras of South Africa, Australia, and temperate South America, are given at some length, and discussed in the light of what is known of geological and climatic changes since the Cretaceous period.

Not the least interesting feature of the volume is a series of short, posthumous sketches of the vegetation of various districts, by the late Prof. A. F. W. Schimper, who was botanist to the *Valdivia* expedition. These sketches, which are marked by Prof. Schimper's usual lucidity, supplement Dr. Marloth's descriptions in many respects.

On p. 188 is a photograph, taken in the Knysna forest district, in which both Prof. Schimper and Dr. Marloth appear. The latter, however, with characteristic modesty, has omitted his own name from the description of the figure. The volume is copiously illustrated by line drawings and photographs. Some of the latter take the form of particularly beautiful heliogravures. There are also a number of useful maps, illustrating the rainfall, geology, and phytogeographical regions of South Africa. Karte 6 would be improved by a clearer method of indicating the regional boundaries.

To sum up, the work presents a most useful account of the present position of geographical botany in South Africa. Its very limitations, particularly in the ecological sections, afford a graphic indication of the enormous (and in many directions practically untouched) field which awaits future investigators.

R. H. Y.

PALÆOLITHIC MAN.¹

RECENT discoveries have filled up to a great extent the gaps in our knowledge of Palæolithic man. The skeleton find in the lower grotto of Le Moustier (Dordogne) in the main confirms Klaatsch's conclusions, based on a comparison of the face-skeleton of the Neanderthal race with that of the present Australians. *Homo mousteriensis* belongs to the older Diluvial race, that is, to the Neanderthal type, not to *Homo sapiens* found in more recent Diluvium. The subject was about sixteen years old probably a male. That *Homo mousteriensis* belongs to the Neanderthal type is further shown by the character of the femur and radius (of which the length is estimated at 195 mm., while the upper arm measures 210 mm.). The Neanderthal race had short extremities, in which fact Klaatsch sees an approximation to the present Arctic races of Mongoloid relationship.

¹ "Recently discovered Fossil Human Remains and their Bearing upon the History of the Human Race," by Moritz Alsberg (*Globus*, vol. xcv., No. 17, May 6, 1909).

Mention must also be made of the extraordinarily massive proportions of the absolutely chinless lower jaw. The knobs on the backs of the incisors recall the Krapina find. All the upper front teeth have much curved roots adapted to the round arching of the upper jaw-bone.

The position of the skeleton at Le Moustier, like that of the find at Grimaldi, proved that Diluvial man buried his dead with care. The posture is that of sleep, with the face turned to the right, and the right arm under the head, which was surrounded by flint flakes. Beside the skeleton were found, in addition to flint implements of the Mousterian type, some of the Acheulean type, among them a splendidly worked "hand-wedge." A mark on the right femur is traceable to burning, but there is no sign of the cannibalism ascribed by Kramberger to Krapina man.

Another important find in France is that of a male skeleton, brought to light by the Abbé A. and J. Bouyssonie and Bardon near La Chapelle-aux-Saints (Corrèze), in an absolutely undisturbed archæological stratum. The subject is an old man of about 1'60 m. in height. The skull is actually 208 mm. long by 156 mm. broad, that is to say, dolichocephalic, with an index of 75. The height from basion to bregma is only 116 mm. The breadth-height index is 62, far outside the variation in living man. The huge, almost round orbits and very wide nasal aperture agree with what has been noted as very remarkable in skulls of the Neanderthal type. Though the face is defective, its prognathous nature is clear. The mandible is of great dimensions, and in so far as senile atrophy has not produced changes, exhibits a formation which agrees in the main with those of lower jaws from Spy, Krapina, La Naulette, &c. Here, too, we have absence of chin, "negative chin-formation" (Klaatsch). The occipital and temporal regions have Neanderthal characteristics. The old man's grave contained no tools of the Acheulean stage. This fact, and the predominance of reindeer-bones in the grave, would lend some degree of probability to the supposition that La Chapelle man belongs to a rather later cultural phase than Le Moustier man. Both are to be taken as representatives of the Neanderthal type, and as belonging to the Middle Diluvium.

P. Adloff has in several publications dealt with the question as to whether the above physical characteristics comprised under the term "Neanderthal race" represent an absolutely fixed human type, or whether they were subject to variations. As regards differences of dentition in different specimens of the Neanderthal type, he comes to the conclusion that by no means insignificant differences do exist; Krapina man especially exhibits a form sharply distinguished from other representatives of the genus *Homo*. Obviously, in a type like the Neanderthal, scattered over a vast area, and doubtless existing for many thousands of years, certain variations must arise by way of adjustment to different climatic conditions, food, mode of life, &c.

Dr. O. Schoetensack has recently made a notable find at Mauer, near Heidelberg, of a fossil human lower jaw, which he has called *Homo heidelbergensis*. It unites two at first seemingly contradictory qualities: (1) massiveness of the body of the jaw, combined with entire absence of chin-projection, breadth and thickness, and special form of the ascending ramus—phenomena usually taken as indicating a development little advanced, so-called pithecoïd qualities; (2) a set of teeth agreeing with that of present man in all essentials, the size of the teeth not surpassing the scale of variation in some still extant primitive peoples (e.g. Australians). No doubt, as Adloff says, the teeth of man are in many respects more primitive than

those of anthropoids, and the pithecoïd characteristics met with in human dentition are actually primitive features. A glance at the lower jaw of a young gorilla or of a South American howler shows a remarkable resemblance of the mandible to that of *Homo heidelbergensis*. Dr. W. Wright has given an account and illustrations of this jaw in NATURE of June 3, p. 398.

In determining the exact position of *Homo heidelbergensis* in the human pedigree, it must always be borne in mind that a huge difference in time exists between *H. heidelbergensis* and the members of the Neanderthal race. Fossil remains of Neanderthal man belong to the Middle Diluvium, coinciding in general with the Mousterian culture period; whereas the remains (of *Elephas antiquus*, *Rhinoceros etruscus*, Falc., and *Equus stenonis*, Cocchi) were found undisturbed in the same stratification with *H. heidelbergensis*, which points to earliest Diluvium or to the transition period from Diluvium to late Tertiary age (Pliocene). The long periods intervening between Neanderthal man and *H. heidelbergensis* are shown by Penck's climatic curve of the Glacial periods (Ice ages), mainly coinciding with the Quaternary age, with warmer inter-Glacial periods between and the Palæolithic culture periods introduced into his diagram. The culture epoch, called Mousterian by the French prehistorians, corresponds, according to Penck, together with the subsequent divisions of Palæolithic culture (Solutrean, and perhaps partly Magdalenian), to the Ice-age divisions, comprising the inter-Glacial epoch, which falls between the Riss- and Würmeiszeit. On the other hand, Penck makes the oldest divisions of Palæolithicum correspond: Acheulean and the preceding Chellean, to the warm intervening epoch of specially long duration between the Mindel- and Risseiszeit. Obviously, the late Palæolithic age (of successive Mousterian, Solutrean, and Magdalenian cultures) lies very much nearer to the present than that earlier division of the Palæolithic age (of Acheulean and Chellean cultures).

The supposition that a very long interval elapsed between Middle Diluvium (with Neanderthal man in Europe) and that earliest Diluvium (of *H. heidelbergensis*) receives indirect confirmation from recent excavations by R. R. Schmidt (Tübingen). He devotes himself chiefly to later divisions of the Palæolithic age, and, working back from the Neolithic age, shows the relatively long duration of the culture-sections which he calls late, high, and early Magdalenian; later and earlier Solutrean; late, high, and early Aurignacian; and late Mousterian. However, the slow and gradual earliest cultural progress of the human race leads one to attribute to those oldest divisions of the Palæolithic age, commonly called Chellean or Acheulean, a still longer duration than to all those later divisions.

Thus an enormously long period must have elapsed between Neanderthal man (generally coinciding with Le Moustier culture) and *H. heidelbergensis* (of earliest Diluvium, or Pliocene-Diluvium transition). No fundamental objection stands against the view of Rutot, Klaatsch, Verworn, and others that the first beginnings of human cultural development reach far back beyond Diluvium into the middle division of the Tertiary period (Oligocene, according to Rutot), and that the much debated eolith is to be regarded as the primitive implement of man at the lowest cultural stage. It is obvious that an extremely long period of slow development must have preceded the production of the "hand-wedge," the characteristic implement of the Chellean age.

Neanderthal man, then, is of slight antiquity as compared with *H. heidelbergensis*. Klaatsch has for years upheld the theory that to discover the roots of

the human race we must go very far back, perhaps even to the roots of the mammalian genealogical tree, and additional probability is lent to this idea by the Heidelberg find. The teeth of the Heidelberg jaw undoubtedly prove that no anthropoid stage preceded that to which the Heidelberg mandible belongs, so that to explain the similarity of human and anthropoid forms we must go back to the remote ancestor from which there branched off on the one side the genus *Homo* and on the other the genera of anthropoids and perhaps of other ape-species. The fact that the origin and development of anthropoids reaches back to the Middle Tertiary age (Miocene) prevents the assumption that the Heidelberg mandible is itself the stage of development at which the anthropoids branched off from the genus *Homo*; this is also rendered improbable by the discovery of eoliths in Middle Tertiary beds. There is nothing to preclude the supposition that the Heidelberg fossil, as regards formation, stood fairly near the point of separation. The line of descent Pithecanthropus-Neanderthal man-recent man has to a certain extent been shaken by the recent researches, which attribute less antiquity to Pithecanthropus than was hitherto supposed to be the case.

At the conclusion of the paper is a brief discussion of the genealogical tree of the phylogeny of man and the anthropoids, recently published by Prof. G. Bonarelli, of Perugia. According to this table *Pithecanthropus erectus*, *Homo heidelbergensis*, and Neanderthal man may be regarded either as successive stages in the direct line of descent of Hominidæ or as offshoots from those stages. A. C. HADDON.

THE ORIGIN OF THE PLANETARY SYSTEM.

DR. SEE contends that the planets and satellites of the solar system were captured and their orbits made remarkably circular by a resisting medium. In his view, therefore, Laplace's nebular hypothesis is altogether wrong, whereas the current view is that it is in the main right, though in need of considerable modification and extension.

Dr. See's paper contains a single table, the object of which is to show that, when the sun and planets are expanded to fill the orbits of the bodies revolving about them, their rotations must have been so slow that it is inconceivable that they could have flung off planets or satellites. As an extract from the tables we may quote that, assuming the law of internal distribution remains unchanged, the principle of conservation of angular momentum implies that the sun, when it filled the orbit of the earth, rotated in 3192 years instead of in 25·3 days, as at present. It is no doubt inconceivable that the matter which now forms the earth was being carried round as an integral part of a nebulous sun at one instant, and shortly afterwards revolving as a planet with 3000 times its former velocity; but Dr. See's figures involve the assumption that the law of internal distribution remains unchanged. He probably regards 3000 as a sufficient factor of safety.

A precisely similar point is made with regard to thirty-three other bodies in the solar system. Dr. See then continues that, as detachment has been disproved, capture is the only other alternative. This is not a proof. There are more things in heaven and earth than Dr. See has dreamed of in his philosophy. Capture is a possibility, but Dr. See has done nothing to raise his theory beyond a mere conjecture, even though he points out, in addition, that a resisting medium would diminish the mean distance and the

¹ "On the Cause of the Remarkable Circularity of the Orbits of the Planets and Satellites and on the Origin of the Planetary System." By T. J. J. See.